**Alabama State Course of Study Objectives for PHYSICS reflected in the ENGINEERING DESIGN, BUILD, AND TEST BRIDGES project.**

**Science, Grade 9 - 12, Physics, 2015**

**Motion and Stability: Forces and Interactions**

2.) Identify external forces in a system and apply Newton's laws graphically by using models such as free-body diagrams to explain how the motion of an object is affected, ranging from simple to complex, and including circular motion.

a. Use mathematical computations to derive simple equations of motion for various systems using Newton's second law.

b. Use mathematical computations to explain the nature of forces (e.g., tension, friction, normal) related to Newton's second and third laws.

3.) Evaluate qualitatively and quantitatively the relationship between the force acting on an object, the time of interaction, and the change in momentum using the impulse-momentum theorem.

4.) Identify and analyze forces responsible for changes in rotational motion and develop an understanding of the effect of rotational inertia on the motion of a rotating object (e.g., merry-go-round, spinning toy, spinning figure skater, stellar collapse [supernova], rapidly spinning pulsar).

**Energy**

5.) Construct models that illustrate how energy is related to work performed on or by an object and explain how different forms of energy are transformed from one form to another (e.g., distinguishing between kinetic, potential, and other forms of energy such as thermal and sound; applying both the work-energy theorem and the law of conservation of energy to systems such as roller coasters, falling objects, and spring-mass systems; discussing the effect of frictional forces on energy conservation and how it affects the motion of an object).

6.) Investigate collisions, both elastic and inelastic, to evaluate the effects on momentum and energy conservation.

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